Citation:

Stevens J, Ahn K, Juhaeri, Houston D, Steffan L, Couper D. Dietary fiber intake and glycemic index and incidence of diabetes in African-American and white adults: the ARIC study. *Diabetes Care.* 2002;25(10):1715-21.

PubMed ID: 12351467

Study Design:

Prospective cohort

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

The purpose of the study is to research the association of dietary fiber and glycemic index with the incidence of diabetes in both Caucasian and African Americans in a multicenter United States based clinical trial.

Inclusion Criteria:

- Participants in The Atherosclerosis Risk in Communities (ARIC) study
- Male and female white participants
- Male and female African American participants

Exclusion Criteria:

- Participants with ethnicities other than white or African American
- Participants who are African Americans from two research sites, Minnesota and Maryland, because of low numbers for analysis
- Participants with diabetes at baseline, defined as:
  - fasting glucose level ≥126 mg/dl, or
  - non-fasting glucose level ≥200 mg/dl, or
  - reported that a physician had told them they had diabetes, or
  - reported taking medication for diabetes within two weeks preceding their examination
- Participants with missing data pertaining to diabetes status at baseline and follow-up visits
- Participants with missing covariate data
- Male participants who consumed <697 or >3,763 kcal/day
- Female participants who consumed <596 or >3,125 kcal/day

Description of Study Protocol:

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Recruitment

The ARIC study was a mulitcenter trial, with participants enrolled from four communities in the United States:

- Forsyth County, North Carolina
- Jackson, Mississippi
- northwestern suburbs of Minneapolis, Minnesota
- Washington County, Maryland

Design

- Participants were given a baseline examination when enrolled including a 66-item semiquantitative food-frequency questionnaire, between 1987 and 1989
- Participants were re-examined in the clinic at four visits for the onset of diabetes, that took place in approximately three year intervals

Statistical Analysis

- All analysis was conducted with and without adjustment for total energy using the residuals method
- Cox proportional hazard regression analysis was used with regards to dietary fiber intake, glycemic index, and glycemic load as predictors of diabetes
- Three-way interactions between sex, ethnicity and each nutritional variable were tested
- Two-way interactions between sex and each nutritional variable were also tested

Data Collection Summary:

Timing of Measurements

- Collected dietary information by a 66 item semi-quantitative food frequency questionnaire at baseline and follow-up every three years
- Collected information on onset of diabetes at baseline and follow-up every three years, defined as:
    - fasting glucose level ≥126 mg/dl, or
    - non-fasting glucose level ≥200 mg/dl, or
    - reported that a physician had told them they had diabetes, or
    - reported taking medication for diabetes within two weeks preceding their examination
- Calculated glycemic load and glycemic index, with white bread as the standard

Dependent Variables

- Onset of diabetes, defined above

Independent Variables

- Dietary fiber intake
    - cereal fiber
    - fruit fiber
    - legume fiber
- Glycemic index, calculated by dividing glycemic load by total carbohydrate intake/day

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Control Variables

Multivariate adjusted hazard ratios for age, BMI, sex, field center, education, smoking status, physical activity

Description of Actual Data Sample:

Initial N: N=12,251 (male and female N not described)

Attrition (final N): N=12,251

Age: 45 to 64 years of age

Ethnicity: 9,529 whites, 2,722 African Americans

Location:

The ARIC study was a mulitcenter trial, with participants enrolled from four communities across the United States:

- Forsyth County, North Carolina
- Jackson, Mississippi
- northwestern suburbs of Minneapolis, Minnesota
- Washington County, Maryland

Summary of Results:

Key Findings:

- Among whites, incidence of diabetes decreases with increasing total dietary fiber. Those with higher dietary intake were more likely to be women, more physically active, more educated and non-smokers.
- There was no association between diabetic incidence and glycemic index in either white or African American participants studied.
- Cereal fiber intake was inversely associated with risk of diabetes in whites.

Characteristics of baseline diabetes-free population by quintiles of total dietary fiber intake

- The incidence of diabetes was higher in African Americans (17.5%) than in whites (10.2%) in the participants studied
- Among whites, incidence of diabetes decreases with increasing total dietary fiber
- Those with higher dietary fiber intake were more likely to be:
    - women
    - more physically active
    - more educated
    - non-smokers

Characteristics of baseline diabetes-free population by quintiles of glycemic index

- There was no association between diabetic incidence and glycemic index in either white or

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African American participants studied

Multivariate-adjusted hazard ratios for association of incident type 2 diabetes (energy-adjusted dietary fiber intake and glycemic index by ethnicity)

- Cereal fiber intake was inversely associated with risk of diabetes in whites (*P*=0.001 for model 1, *P*=0.006 for model 2)

Author Conclusion:

There was no association between total dietary fiber intake, glycemic index,or glycemic load and diabetes risk. Cereal fiber intake was significantly inversely associated with risk of diabetes among white participants. Further studies are needed to determine the role of dietary fiber and glycemic index in African Americans.

Reviewer Comments:

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes

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2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	N/A
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes

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5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	???
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes

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	7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**		Yes
	8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
	8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
	8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
	8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
	8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**		Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		Yes
	10.1.	Were sources of funding and investigators' affiliations described?	No
	10.2.	Was the study free from apparent conflict of interest?	Yes

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